

STANDING WAVES ON A STRING (or Vibrating Along)

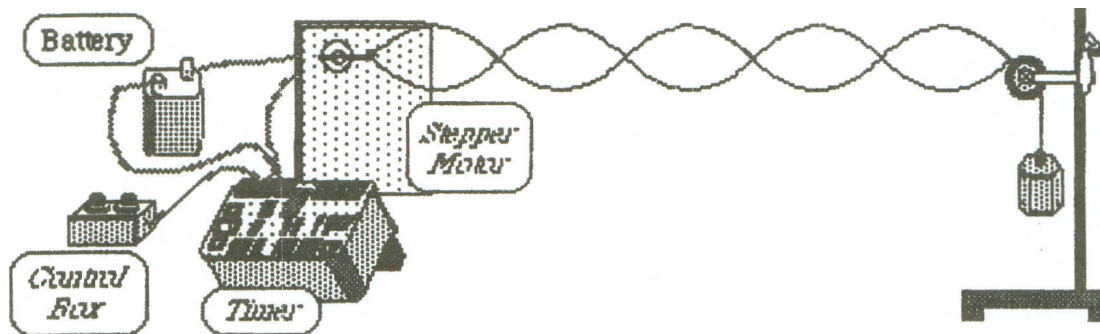
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NAME: _____

PURPOSE:

We will investigate the relationship of the frequency of a wave to its wavelength and to the speed of the wave on a string. We will look at the conditions necessary for a standing wave to occur.

SET UP:



*A device called a "stepper motor" will be used to vibrate a cord. The motor is driven by a 6 volt battery or power supply. The frequency at which the motor "steps" is controlled by dials for coarse and fine adjustment. The actual frequency at which the motor is driven will be read directly by the Timer.

TIMER SETTINGS:

Blue Decimal: XXXX. s (The readout will be 100 times the motor frequency, read as XX.XX Hz)
Brown SWITCH: 00 NOT USED
Green MODE: 11 FREQ METER

PROCEDURE :

1. Provide tension on the string by hanging a weight on the end of the string. The frequency at which the motor is driven will be gradually adjusted upward until an obvious standing wave pattern is produced. Carefully adjust the frequency for maximum amplitude; record the frequency.
2. Record the number of segments; measure the length of the cord.
3. Change the tension on the string by replacing the hanging weight with one of a different magnitude and repeat steps 1 and 2.

DATA and CALCULATIONS:String Tension: **Tension** = $mg =$ _____ N

Number of segments	Length of Cord (m)	Frequency f (Hz)	Wavelength λ (m)	Wave Velocity (m/s)

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$$\lambda = \frac{2L}{\text{number of segments}}$$

$$v = f\lambda$$

ANALYSIS:

1. Is the velocity of the wave on the string a constant at the same tension?

2. Why is this?

3. Is the wave velocity higher or lower with increased tension on the string?

4. At the same frequency, is the wavelength longer or shorter at higher tensions?

5. Calculate the ratio of forces on the string.

6. Calculate the ratio of velocities on the string.

7. Calculate the square root of the ratio of forces.

8. How does the speed of a wave on a string depend on the tension (force) on the string?
